TRIANGLES

BASIC CONCEPT OF TRIANGLES

INTRODUCTION:

Every figure has a shape, size and a position. If we are given two figures then by simply looking at them carefully, we can decide whether they are of the same shape or not. If two figures cover each other exactly then clearly they are of the same shape and same size. Then these two figures are called congruent figures. This method of comparing two figures is known as the method of superposition. In this chapter we will study the basic criteria for congruency of special figures.

TRIANGLE

A plane figure bounded by three lines in a plane is called a triangle. Every triangle have three sides and three angels. If ABC is any triangle then AB, BC & CA are three sides and $\angle A$, $\angle B$ and $\angle C$ are three angles.



(a) Types of Triangles :

(i) On the basis of sides we have three types of triangles:

(A) Scalene triangle :

A triangle whose no two sides are equal is called a scalene triangle.

(B) Isosceles triangle:

A triangle having two sides equal is called an isosceles triangle.

(C) Equilateral triangle :

A triangle in which all sides are equal is called an equilateral triangle.

(ii) On the basis of angles we have three types of triangles :

(A) Right triangle :

A triangle in which any one angle is right angle $(=90^{0})$ is called right triangle.

(B) Acute triangle :

A triangle in which all angles are acute $(>90^{\circ})$ is called an acute triangle.

(C) Obtuse triangle :

A triangle in which any one angle is obtuse ($<90^{\circ}$) is called an obtuse triangle.

Basic concept of triangle:

- (i) Orthocenter is the point of intersection of the altitudes.
- (ii) Circumcentre is the point of intersection of the perpendicular bisectors of the sides.
- (iii) In centre is the point of intersection of the angular bisectors.
- (iv) Centroid is the point of intersection of the medians.
- (v) The circumcentre of a triangle is equidistant from its vertices.
- (vi) The in centre of a triangle is equidistant from its sides.
- (vii) The centroid divides a median in the ratio 2 : 1.
- (viii) The orthocentre of a right angled triangle lies at the vertex containing the right angle.

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Note :

- (1) All four points are coincide for an equilateral triangle.
- (2) Orthocentre (H), Centroid (G), Circumcentre (O) are always collinear points and G

divides OH in ratio 1 : 2.

ANGLE SUM PROPERTY

Theorem :

Prove that sum of all three angles is 180° or 2 right angles.

Given : $\triangle ABC$

To prove : $\angle A + \angle B + \angle C = 180^{\circ}$

Construction : Draw PQ || BC, passes through point A.



Proof:

: PAQ is a line

 $\therefore \angle 1 + \angle 2 + \angle 3 = 180^{\circ}$ (linear pair application)

 $\angle B + \angle 2 + \angle C = 180^{\circ}$

 $\angle B + \angle CAB + \angle C = 180^{\circ}$

= 2 right angles. **Proved.**

Theorem :

If one side of a triangle is produced then the exterior angle so formed is equal to the sum of two interior opposite angles.



Means $\angle 4 = \angle 1 + \angle 2$

Proof:

 $\angle 3 = 180^{\circ} - (\angle 1 + \angle 2)$ (1)

(by angle sum property)

and BCD is a line

 $\therefore \ \angle 3 + \angle 4 = 180^{\circ}$ (linear pair)

or $\angle 3 = 180^{\circ} - \angle 4$ (2)

by (1) & (2)

 $180^{\circ} - (\angle 1 + \angle 2) = 180^{\circ} - \angle 4$

 $\Rightarrow \angle 1 + \angle 2 = \angle 4$ Proved.

CONGRUENCE OF TWO FIGURES :

Two geometrical figures in a plane are congruent if, without bending or twisting, we can superimpose one figure on the other so that the two can be brought into coincidence.

 (i) Two line segments are congruent if and only if they have the same length. For example, if AB = CD, then AB and CD arecalled congruent line segments.



(ii) Two angles are congruent if and only if they have the same angle measure. For example, if $\angle BAC = \angle DEF$, then $\angle BAC$ and $\angle DEF$ are said to be congruent angles.



(iii) Two circles are congruent if and only if they have the same radius.



Congruence of Two Triangles :

Two triangles ABC and DEF are congruent if and only if all the sides and angles of one triangle are equal to the corresponding sides and angles of the other.

We write $\triangle ABC \cong \triangle DEF$



AB = DE, BC = EF, CA = FD,

 $\angle A = \angle D$, $\angle B = \angle E$, $\angle C = \angle F$

Note: Corresponding Parts of Congruent Triangles are Equal [CPCT]

If two triangles are congruent then their corresponding parts are equal.